Preface

The purpose of this special issue is to present a collection of papers in numerical linear algebra which involve the development and analysis of rigorous mathematical models or algorithms for solving problems involving large scale matrices. In recent years, large scale matrix problems of ever-increasing size have arisen. One reason for this is that modern acquisition technology allows the collection of massive amounts of data. Another factor is the tendency of engineers and scientists to formulate more and more complex and comprehensive models in order to obtain fine resolution and realistic detail in describing physical systems. It is important to note that the ability of mathematicians and computer scientists to handle increasingly larger problems is at least as much due to the improvement of existing algorithms and software and the development of new and more elaborate methods as to the increase in the computing power of modern machines. Particular areas in which such large scale matrix problems occur include the least squares adjustment of geodetic data, the least squares fitting of multivariate data by splines, the computation of stationary distribution vectors of infinite Markov decision chains, the computation of eigenelements of large symmetric and unsymmetric matrices, the solution of large scale quadratic programming problems and the solution of maximum entropy problems in image reconstruction and transportation planning. Each such application area is represented in one or more papers in this issue.

We have loosely organized the papers into general categories which deal, respectively, with (1) Least squares and applications, (2) Systems of linear equations and applications, (3) Eigenvalue problems, and (4) Optimization problems. Within each category we have chosen to arrange the papers in the order in which they were recorded as received by the Editors. The general category in which a specific paper is placed is determined partly by its area of application and partly by its mathematical character.

The first category contains papers which describe new or improved algorithms for solving large sparse linear least squares problems. Applications are given here to the adjustment of massive amounts of geodetic data and to the fitting of multivariate data by tensor spline approximations.

The second category is concerned with methods for solving systems of linear equations. The methods involve both iterative and sparse matrix direct techniques, together with combinations of the two. Particular attention is paid here to the speed of the algorithms in question.

Category three contains papers on computing eigenelements of large sparse matrices. The methods described here involve Raleigh quotient minimization, the Lanczos algorithm, and variations of Arnoldi's method.

The fourth and last category is concerned with selected problems involving optimization techniques. Linear complementarity problems and entropy maximization problems and applications are discussed, as well as new techniques for solving certain classes of quadratic programming problems.

In a more general context, this special issue presents research papers in numerical linear algebra, but with considerable influence from computer science. In addition, many of the papers are permeated with the application of large scale matrix algorithms and software to the solution of current and relevant engineering and scientific problems.

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